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UNITED STATES DEPARTMENT OF AGRICULTURE
Research Program Development and Evaluation Staff
Washington, D. C.

REPORT AND RECOMMENDATIONS
of the
PLANT SCIENCE AND ENTOMOLOGY RESEARCH ADVISORY COMMITTEE
Developed at its Meeting
March 7-11, 1966
Tifton, Georgia

PLANT SCIENCE AND ENTOMOLOGY RESEARCH ADVISORY COMMITTEE

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CURRENT SERIAL RECORDS

PREFACE

The Committee reviewed annual Progress Reports and other resource materials relating to broad aspects of the research programs of the Crops and Entomology Research Divisions, Agricultural Research Service. Research leaders briefly described the Divisions' programs and defined some important accomplishments and needs. Some Federal and State scientists associated with the Georgia Coastal Plain Agricultural Experiment Station at Tifton gave several on-site demonstrations of procedures, facilities, and problems yet to be solved.

Dr. G. L. Mehren, Assistant Secretary and Acting Director of Science and Education, is Chairman of the Committee; Dr. H. A. Rodenhiser, Deputy Administrator for Farm Research, Agricultural Research Service, is Vice-Chairman. Dr. M. G. Weiss, Assistant to Dr. Rodenhiser, chaired the meeting.

I N D E X

	<u>Page</u>
General	1
Pesticides and Growth Regulators	2
Plant Introduction and Evaluation	4
Plant Breeding and Genetics	5
Crop Quality	5
Plant Culture and Management	5
Perennial Grasses and Legumes	6
Biological and Cultural Control of Weeds	6
Biological and Cultural Control of Plant Diseases	7
Mycotoxins	7
Isolation Laboratory	7
Biological and Cultural Control of Nematodes	8
Light and Plant Growth	8
Air and Water Pollution	8
Stress Physiology of Plants	9
Remote Sensing for Agriculture	10
Insect Identification and Classification	10
Basic Insect Biology, Physiology and Pathology	11
Biological and Special Chemical Methods of Pest Control	11
Insect Vectors of Plant and Animal Diseases	12
Bees and Other Pollinating Insects	13

COMMENTS AND RECOMMENDATIONS

GENERAL

The world food shortage demands that every possible source of food be protected and that efficient ways to expand food supplies be under continuous and expanding research investigation. Agricultural research on food and feed crops should be maintained, and increased where necessary to achieve a continuous research program in harmony with present and anticipated needs.

The Committee takes note of budget decreases for crops and entomology research. It is concerned over an inconsistency in the proposed support for research on crops presently in excess of domestic needs, e.g., there are severe reductions in support for wheat, corn and grain sorghum, whereas there is a slight increase for cotton. We realize that it is necessary to realign research efforts as new problems arise and the relative importance of old programs becomes less. However, it is recommended that vital research programs authorized and initiated at considerable cost be continued as long as they are productive and have a sound scientific and economic basis. Abrupt termination of research programs may result in the loss of valuable biological materials and experienced scientific personnel. We strongly recommend that modification of research emphasis, when this is necessary because of budgetary cuts, be the responsibility of administration at division and branch levels. The importance of this cannot be overemphasized.

The Committee is in sympathy with the effort to evaluate the potential economic return of different research activities. We believe that this type of evaluation can be validly made for developmental and/or mission oriented research. However, basic research efforts are designed to obtain fundamental scientific knowledge and attempts to express basic aspects of new discoveries in terms of objective, predictable economic returns will be of little value. Evaluation of basic research should be made on a scientific basis by people qualified by training and experience to judge its quality and possible effectiveness.

Increases in extramural research programs were noted with pleasure. These programs indicate an expansion in cooperative research between USDA and outside agencies such as land-grant colleges and universities. Such efforts should be mutually beneficial. There are many advantages of close association with State and local agencies responsible for research on food and fiber crops and the protection of man and animals. Continued support of extramural research programs is recommended.

In view of the difficulties experienced in filling many positions within the Crops and Entomology Research Divisions, the Department should continue to concern itself with the training of young scientists through cooperative research, research grants, and contract research in ways that will support graduate students, as well as specific research problems.

The Committee reiterates its concern about the present limitation on the number of scientists in the GS-14 grade and higher. Top scientists are essential to give the necessary leadership in many areas of work, but this

objective is not fully attainable with the present arbitrary salary limitations. This situation has been aggravated by an accelerated rate of retirement during the year.

PESTICIDES AND GROWTH REGULATORS

The opinions and recommendations made in the 1965 report of this Committee are reaffirmed. We are gratified to note that many of the suggestions in that report were implemented in a modest way in the fiscal year 1966 and that further work on the recommendations is planned for 1967.

The Committee believes that at present the best available practical method for the control of most insects and other pests is still by means of chemical pesticides. Therefore, research effort which will increase the safety and effectiveness of this method of control should be maintained.

It is recommended that more research be undertaken on the integration of chemical and biological control methods. Studies should be conducted on timing, rates and methods of application of pesticides to determine how these can be made with as little effect as possible on insect parasites and predators. In this way, it should be possible to reduce the total amount of pesticide required while still obtaining economic control.

We are concerned that there is little coordinated research effort being expended on investigation of insect resistance to chemical pesticides, although note is made of the excellent work along these lines at the laboratory in Corvallis, Oregon. It was reported to the Committee that the USDA has withdrawn 79 recommendations for specific insecticide treatments due to development of resistance. In view of the magnitude of the problem and the necessity for continued use of chemical pesticides in crop production, it is recommended that fundamental research be expanded on the genetic and biochemical basis for resistance of insects to pesticides.

Research on residues should be increased and directed toward studies in which factors such as the movement and persistence of pesticides in soil, possible contamination of ground water, pesticide drift and biodegradability are investigated. Current interest in environmental contamination by pesticide residues underlines the importance of this type of investigation. In these studies maximum use should be made of the information available from industry and other sources.

The addition of pesticide chemicals to the soil may have marked effects on its chemical, biological, and physical properties. Increased research on the effects of the more commonly soil-applied pesticides on soil microorganisms, uptake of nutrients, plant growth, and plant composition is urgently needed. In addition to work on individual chemicals, these effects should also be investigated on the more commonly used mixtures applied to soil. Such studies are indicated by the possibility of interactions which may affect the results obtained with a single chemical. In addition, research should be undertaken to determine the cultural methods which would be most useful for removing excess chemicals from soils containing appreciable residues of persistent pesticides.

The methods of formulation and application of a chemical may markedly affect its persistence and biological efficacy. The recent work on low-volume applications of highly concentrated chemicals has shown this to be true. The USDA is to be commended for its research in this field, but this type of investigation needs to be greatly expanded. Some factors which could be investigated are: the type of deposit which gives most effective control of different types of pests; the effects of different solvents, and other adjuvants on the nature of pesticide deposits; and the effect of particle size on biological efficacy. The type of application equipment used is also very important. Such studies will require a coordinated effort by chemists, biologists and engineers.

The drift problem is one which has been causing increasing concern during recent years and which requires further study. Standardized studies on the amount of drift from spraying under different wind and climatic conditions with different types of formulations should be expanded. Consideration should be given to residues resulting from drift and to possible crop injury.

The metabolism studies being conducted at the new laboratory in Fargo, North Dakota, are to be commended. It is recommended that in conducting these studies, the comparative metabolism of different members of classes of pesticides be investigated. It is also urged that full cognizance should be taken of all of the metabolism work which has been done in support of pesticide registration applications.

The Committee is pleased that basic studies on fungicides are moving ahead by placement of contract research, but it is concerned that planned facilities to house such operations at Beltsville are not being constructed. New approaches for the use of chemicals to control diseases should be investigated. A systemic fungicide would be highly desirable. Additional information is needed regarding the absorption, translocation, and mechanism of fungicidal action. This information should aid in the search for new, more effective, and safer chemicals for disease control.

Uncontrolled bacterial diseases of plants cause significant crop losses in many localities. During recent years, severe losses have occurred on a number of high value crops. Additional research on chemical control of these diseases is recommended.

The Department is commended for initiating research to determine the effect of nematocides on replant and decline problems of certain fruit, citrus, and nursery stock. Nematodes are also known to cause losses in many other important crops. Work is needed to establish new or improved methods for controlling nematodes. The relation between chemical structures and biological response of nematodes should be investigated. Research on the control of nematodes by chemicals should be maintained.

The important role of the excellent USDA research program in the development and use of herbicides for the control of many important weeds is noted. However, new principles and methods of using herbicides need to be developed so that little or no harmful residues are left in the environment. Additional

research is needed to develop information regarding the interactions of pesticides with respect to crop tolerance and weed control. Further research on the penetration, absorption, and translocation of herbicides is also recommended. Further information is required regarding the relations of chemical structure and formulations to herbicidal activity and factors causing selective herbicidal action.

The Department is commended for important new findings in the field of growth regulators. The discovery of compounds which control abscission, affect fruit retention and maturity of plants is extremely important and opens up new potentially useful areas of research. Basic work in the field of growth regulators should be continued.

The Committee wishes to recognize the Entomology Research Division for the preparation of the excellent Agricultural Handbook No. 290 entitled "Suggested Guide for the Use of Insecticides to Control Insects Affecting Crops, Livestock, and Households 1965." The Committee feels that a companion handbook of fungicides, herbicides, nematocides, and plant regulants would be useful.

PLANT INTRODUCTION AND EVALUATION

The cooperative program of plant introduction, evaluation, and maintenance of germ plasm is vital in crop improvement programs of all public and private agencies. Needs of agriculture for accelerated research on natural sources of resistance to insect pests and diseases continue to justify expansion both in plant exploration and preliminary evaluation of collected materials. The Committee is disappointed to note that contrary to last year's recommendation, there has been a substantial reduction rather than a strengthening of this program.

The Department is to be commended for responding positively to the recommendation to utilize automatic data processing techniques in evaluating plant introductions and in quickly retrieving data that provide plant breeders with information on sources of desired genetic characters.

The transfer of research on crambe to the Oilseed & Industrial Crops Research Branch by July 1, 1967, clearly illustrates the potential of introducing and establishing crops with new uses. There are numerous other potential possibilities which, with adequate research involving genetics and agronomic practices, might well be developed. Much of the effort on introduction and screening for useful chemical constituents will have been wasted without the research necessary to make the production of a new crop successful and profitable under farm conditions. Therefore, added support in this area is strongly urged.

The continued need for plant exploration and collection for needed genetic materials for existing crops is also emphasized. The most economical and often the only source of needed resistance to insects and diseases is to be found in introduced plant materials. Therefore, efforts in collecting and screening for valuable genetic characteristics should be expanded.

PLANT BREEDING AND GENETICS

The Committee was pleased by a small increase in the support of this important segment of the Agricultural Research Service program in fiscal year 1966, even though it was inadequate. At the same time, the proposals for severe reductions in many portions of the program for fiscal 1967 are cause for grave concern.

The relatively large program, which is fully justified by the needs involved, is well conceived, efficiently organized, and is producing much valuable information and materials. Changes in operation incorporated during the past year appear to have strengthened the program. Needed alterations should continue to be incorporated in the future. However, we reiterate, that implementation of the drastic reductions proposed for 1967 will not only seriously curtail a sound program in the immediate future, but will have far-reaching and damaging effects for many years to come. We strongly emphasize that the splendid programs of research on such crops as corn, wheat, and grain sorghum should not be reduced, but rather should be strengthened. Such crops as these constitute the backbone of our agriculture -- the future will prove that we were shortsighted indeed if we fail to pursue a vigorous research program to maintain and strengthen the leadership of the United States in the efficient production of these crops.

There continues to be critical need for research directed toward isolating and elucidating morphological, physiological, pathological, biochemical, and other characters and phenomena in plants which have a bearing on immunity, resistance, and/or susceptibility to pathogens and insects. There is equal need for expanded basic genetic research on both the crop host and plant pathogens, insects, and nematodes, including the complementary biochemical and physiological studies of gene interrelationships.

CROP QUALITY

A recommendation for research to establish criteria for the objective determination of quality in all major food and feed crops is repeated. The work reported in cotton is a good example of what can be achieved. There are many other crops for which objective techniques for quality determination are needed. The present levels of uniformity and selectivity that have been reached are a tribute to the ability, experience, and training of those making the judgments. With a suitable research basis, standards could be established which would provide for much greater precision and which could be applied by individuals who have far less familiarity with the agricultural products being evaluated. With constantly expanding demands, the need for such standards has become critical. Their absence is a limiting factor in too many cases.

PLANT CULTURE AND MANAGEMENT

The Committee favors proposed shifts in manpower if such action will contribute to more efficient and productive research. We feel strongly, however, that forage and range production and management research programs have been seriously understaffed. The broad needs can only be met on an expanded rather than a curtailed basis.

The sharp reduction in available agricultural labor has increased the demands for laborsaving management practices and ways to utilize unskilled employees. Adaptation to mechanization necessitates radical alteration of production methods. These must be coordinated with other emerging techniques to achieve economic production. Modern varieties, materials, and techniques require improved cultural practices. For example, desirable rootstocks could contribute significantly in tree fruits, with the greatest present need being in stone fruits. Increased research to establish the most efficient combination of such cultural practices is recommended.

PERENNIAL GRASSES AND LEGUMES

A need for increased research on perennial grasses and legumes was recognized in the 1965 report of this Committee. We are concerned by the continued lack of emphasis on these important crop plants, and by the obvious fact that its general recommendations have not been implemented. Therefore, two specific recommendations are made:

1. That a forage and range grass research program be provided as an integral part of the new Meat Animal Research Center at Clay Center, Nebraska. This facility offers an excellent opportunity for research on the improvement of grasses and legumes with particular emphasis on breeding for improved quality; developing techniques for measuring forage quality; stabilizing forage resources; and increasing the return from grazing and conserved forages. Coordination with livestock specialists should be developed through a well balanced interdisciplinary research team.
2. The critical need for research in turfgrass physiology and genetics should be met by developing centers within the Crops Research Division. The poorly supported programs at Tifton, Georgia and Beltsville, Maryland should be strengthened by the addition of needed specialists. Research programs in turfgrass improvement could be greatly enhanced by the establishment of a comparable research team at a center in the Western United States.

BIOLOGICAL AND CULTURAL CONTROL OF WEEDS

The Committee recognizes that the use of herbicides has made possible the continuous production of many crops that would have been decreased in volume and, therefore, would have been increased in cost to consumer if conventional weed control methods had been used. However, some weed-infested areas of rangelands and aquatic sites are too extensive for economic chemical control. Also, in those cases where herbicides are economically attractive, growers must use care to avoid residues in food, feed, and water. Biological and improved cultural control of weeds are promising alternatives for dealing with these problems. Basic to this approach is seed dormancy, which in many cases determines if a plant is a weed. There should be:

1. Increased development of in-depth studies of the life cycles of weeds and their predators. The chemical and physiological phenomena governing seed dormancy, seed germination, growth and reproduction

of plant parts which multiply the weed are central to this effort. Exudates from plant roots and plant residues which may influence plant growth or seed germination should be studied.

2. Continued search for, and study of, predators, diseases, and plant competitors designed to eliminate weeds. Examples such as the seed head fly attacking tansy-ragwort, a beetle to kill puncture weed, the identification of an extract from corn which stimulates witchweed seed to germinate, illustrate research in this area that is worthy of increased support.

BIOLOGICAL AND CULTURAL CONTROL OF PLANT DISEASES

Although inherent resistance still appears to be the most effective way in which to achieve biological control of plant pathogens, there are numerous diseases for which resistance has not been discovered. It is urged that greater emphasis be given to cultural practices that may be effective in controlling diseases for which fungicides or resistance are unknown.

As mentioned earlier, bacterial diseases cause serious crop losses. This class of pathogens has not received the attention that is warranted. It is urged that steps be taken to initiate more research on bacterial diseases and on the taxonomy of bacterial plant pathogens.

Research on the control of soil-borne pathogens by means of soil amendments should be continued. These studies should receive such support as may be needed to determine and evaluate the biological phenomena involved. It is more important at this time to discover the principles involved than to seek a practical application.

MYCOTOXINS

The effect of microorganisms on the quality and safety of food and feed products is a subject of concern. The Committee takes note of the expanded research effort on peanut mycotoxins and toxin-producing molds on soybeans. Research should be established to investigate other food and feed products with emphasis on understanding the interactions between microorganisms and environmental factors at various stages of plant growth and development. The research should be broad in nature and directed towards understanding the basic principles involved in the biology of microorganisms, the nature of toxins produced, and the biological effects of the mycotoxins on plants and animals.

ISOLATION LABORATORY

It is generally recognized that border plant quarantines have been effective in preventing the introduction of numerous plant pests into the United States. From time to time destructive plant pathogens have been introduced despite plant quarantines and inevitably others will cross our borders in the future.

It is urged that a study be made promptly in an effort to establish a laboratory at some isolated, offshore location where potentially destructive plant pests not present in the United States can be studied. The facility could also

benefit underdeveloped nations where suitable facilities are not available. The location of the laboratory should be carefully selected in order to provide: (a) an appropriate environment for temperate zone plants, (b) sufficient isolation to prevent introductions into the United States by means of migrating birds and insects, and (c) isolation from areas visited by tourists.

BIOLOGICAL AND CULTURAL CONTROL OF NEMATODES

The control of nematodes by crop rotation and cultural practices has been effective with some crops. Parasitic fungi and a flat worm have been found to attack parasitic nematodes. These and other methods of biological control have not been extensively investigated. It is recommended that more research be conducted to determine how such techniques can be used more extensively and more effectively. The relationship between physical, chemical and biological properties of soils and nematode populations needs additional study.

LIGHT AND PLANT GROWTH

Agricultural scientists have made significant contributions to our understanding of the effects of photoperiod and temperature on plant growth and development. Much of the recent work has been concerned with flower development on ornamental plants. Similar research is needed on agronomic crops and should include studies on the effect of photoperiod and temperature on fundamental biochemical, morphological, and anatomical aspects of plant growth and development.

Light quality is also an important factor in controlling plant growth and development. One area of particular interest is measurement of the photosynthetic efficiency of plants. There are indications that differences exist between plant species in their ability to utilize radiant energy for photosynthesis. This problem should be investigated to determine if photosynthetic efficiency may be manipulated in a breeding program.

Considerable progress has been made in recent years in elucidating the mechanism of photosynthesis in plants. A great deal of the research has been carried out on unicellular algae. It would be of great value to expand this research to vascular plants, particularly those of agronomic importance.

In addition to photosynthesis, certain wavelengths of radiant energy have specific effects on plant growth and development. It is urged that research on these phenomena be continued and expanded to include the major agronomic crops. Similar studies on weed species might reveal growth phenomena useful in controlling their development.

The specialized facilities available at Beltsville, Maryland for studying the effects of radiant energy on plant growth and development should be utilized for the investigations mentioned in the preceding paragraphs.

AIR AND WATER POLLUTION

Expanded research is needed to determine the effects of pollutants on plants as a part of the extensive research program now underway to study the effects

of pollutants on man and his environment. The following questions are examples of those that must be answered:

1. What are the major pollutants in the environment?
2. How do these pollutants affect plant growth?
3. What are the biochemical, morphological and anatomical effects of pollutants on plants?
4. What is "hidden damage" and to what extent does it limit plant productivity?
5. What are the possibilities of discovering specific pollutant-tolerant or -resistant plants among the germ plasm available to agricultural scientists?
6. How do problems of waste disposal at the farm and city level affect crop production?

USDA scientists should be directly involved in studying the effects of pollutants on plant growth. Other State and Federal agencies are also carrying out research in these fields and the Department of Agriculture should make a vigorous attempt to establish cooperative programs with these agencies to avoid duplication of effort.

STRESS PHYSIOLOGY OF PLANTS

National concern for plant materials suitable for food, feed or beautification demands increased emphasis for research in stress physiology. A team approach with coordination of effort among several disciplines is most desirable. The effort should be supported in several climatically different regions.

The problems to be solved include tolerance to cold, heat, drought and flooding. Also plants grown in soils of high salt content occurring naturally or as a result of a long irrigation history must be studied. It is suggested that increased attention be given to a number of areas such as:

1. Basic cell biology to more readily understand ultrastructure and membrane transformations under stress conditions.
2. Physiological studies of plant materials to determine ability to withstand mechanical as well as environmental stress under such conditions as mechanical harvesting, roadside maintenance and highway salt.
3. Metabolic studies during growth and development of the plant, e.g., vernalization and dormancy.

REMOTE SENSING FOR AGRICULTURE

Speed in identifying outbreaks of plant pests is of paramount importance. Agricultural research agencies must join with other research agencies, especially those that are space oriented, to research and organize a vigilant monitoring system to protect our food supply from disease and insect attack.

The use of infrared aerial photography and other screening devices are beginning to be researched for orbiting satellite installation but the use of remote sensing from suborbital aircraft might be more immediately effective. The parameters of such an approach should be known for use in taking an agriculture plant and animal census including volume, distribution and kind of vegetative cover, and the number and kinds of animals observed. Basic ground level research dealing with observable characteristics of plants and animals such as reflectance color, shape and height is needed immediately. The Committee feels that this is a tool agriculture must use and coordination is necessary with all agencies involved. Funds should be sought for agriculture.

INSECT IDENTIFICATION AND CLASSIFICATION

The Committee is pleased that two research grants and one research contract have been activated with universities on taxonomic research, that a professional will soon be secured for taxonomic studies on parasites such as fleas and lice that feed externally on man and other animals, and that results from P.L. 480 grants are encouraging.

We were disappointed that it has not been possible as yet to secure support for the key taxonomists to relieve them of the heavy burden of preparatory work and routine identification. It is hoped that additional nonprofessional assistance can be obtained to permit at least one assistant for each senior scientist.

It is recommended that additional professional taxonomists be added to the staff for identification and classification of several large groups of plant-feeding insects, such as weevils and larvae of moths.

There is a need for initiation of research that will provide experimental evidence for distinguishing between species of insects that cannot be recognized on anatomical characters. This Committee has recommended that required facilities, including adequate insectaries, greenhouses, and specialized laboratories, be made available for this research. It is more likely that such facilities could become available in suburban areas rather than in urban areas. Furthermore, ready availability of an adequate library on agricultural literature is essential to a research program on insect classification. These two requirements, adequate space and library, are suitably met at the Agricultural Research Center at Beltsville, Maryland.

It is apparent also that the National Collection of Insects, assembled and maintained by joint effort of the Natural History Museum of the Smithsonian Institution and the Entomology Research Division of the U.S. Department of Agriculture, is an essential working tool in the conduct of research in insect classification and the performance of an insect identification service. It

follows, therefore, that joint participation by the Smithsonian Institution and the U.S. Department of Agriculture is necessary to provide these needed facilities. It is recommended that the Department of Agriculture take the initiative in providing for a joint study by the two agencies of the feasibility of establishing a laboratory at Beltsville, Maryland for the classification of insects. It is further recommended that if such a laboratory is determined to be feasible, the two agencies take the steps necessary to insure its establishment.

BASIC INSECT BIOLOGY, PHYSIOLOGY AND PATHOLOGY

The additional facilities and effort that have been directed towards research in the area of basic insect biology, physiology, and pathology during the past year are noted with pleasure. The Committee understands that a new headhouse-greenhouse at Beltsville for use by the Insect Pathology Pioneering Research Laboratory is nearing completion and that studies of the effects of meteorological factors on insects have been initiated at Beltsville and Brownsville.

It is noted that research on mode of action of insect viruses, and tissue culturing of entomophagous microorganisms has been intensified; also, that extramural grant programs with universities have been negotiated for development of methods of mass-rearing four major insect pest species and their virus diseases. These programs in this area of research appear to be adequately supported, and quite productive in yielding knowledge that is fundamental to many of the other entomology research programs. They should be continued.

BIOLOGICAL AND SPECIAL CHEMICAL METHODS OF PEST CONTROL

Though research on biological and special chemical methods of insect control is being expanded, the generally recognized and expressed need to keep toxic residues at an absolute minimum in the agricultural environment dictates that this limited expansion is far from adequate. It is significant to note that all plant-commodity-oriented agricultural research advisory committees recommended increased research in biological and special chemical methods of insect control.

It is urged that efforts be continued, as recommended by the Committee last year, to expand research in all areas of biological and special chemical methods of insect control including the use of parasites and predators, pathogens, attractants and repellents, sterilants, cultural and mechanical control and integrated control.

Efforts should be continued to complete the building and to secure staff for the Biological Control of Insects Research Laboratory to be developed at Columbia, Missouri.

Research should be expanded on the utilization of periodic mass release of beneficial organisms for control of pest species. Additional basic information is needed on nutrition of parasites and predators to assist in the effectiveness of large-scale release programs. Greater knowledge of insect nutrition would be helpful in such programs both in the development of insectary rearing of the millions of beneficial insects required for release and for food

supplements in the field. Research should also be expanded on the utilization of such large-scale release programs in integrated control methods.

There should be a concentrated research program on the biological control of aphid and leafhopper vectors of virus diseases. Such a program should include (1) the introduction of new species of parasites, predators and disease organisms; (2) large-scale release of beneficial organisms, including pathogens of destructive insects; (3) the use of food additives in the field for the released organisms; (4) manipulation of environmental factors to favor the beneficial organisms; and (5) special chemical methods compatible with biological control.

A research program should be developed to determine the chemical factors involved in the selection of host plants by insects. Very little is known about the factors that cause insects to seek and feed on certain species of plants, or oviposit on them while avoiding others. Research on the chemistry of plants to determine attractant or repellent factors, should yield information on basic chemical differences. This information could be utilized in the development of attractants for insect survey and control, or of repellents for crop protection and would serve as a guide in the development of insect-resistant studies of plants.

Research on insect population control has been initiated by the Department of Agriculture. The Committee strongly supports the development of a laboratory for this purpose.

As research advances into highly promising new approaches to insect control, the need for research in isolated areas on the total population of insects becomes more and more apparent. Because of extensive movement of most insect species, it is virtually impossible to appraise the impact of various control methods on small segments of insect populations as we now attempt to do. Research on the ecology, behavior, and control of total insect populations can only be carried out on isolated populations in areas sufficiently small to conduct the research within the financial means available to research organizations. Isolated islands provide the opportunities for conducting such research.

INSECT VECTORS OF PLANT AND ANIMAL DISEASES

The Committee agrees with the shift in emphasis during the past year from methods of control of insect vectors of plant diseases to studies on the transmission of viruses. Adequate knowledge of the identity, distribution, and transmission of pathogenic viruses must be available before reliable procedures for control can be devised. Attention is called to the current importance of sugarbeet viruses, corn stunt, maize dwarf mosaic, and peanut stunt virus. There is a need for intensive fundamental research on arthropod vectors associated with the overwintering hosts, spread, and transmission relationships of these diseases in order that control recommendations can be developed.

It is strongly suggested that an appreciable increase be made in work on arthropod transmission of livestock and poultry diseases. Only a small effort is being devoted to such research. Among the more serious livestock diseases needing attention are bovine anaplasmosis, equine piroplasmosis, and blue tongue

virus of sheep which also affects cattle. There needs to be additional effort to determine the principal vector species, the nature of the vector-host relationships, and the epidemiology of these diseases. Such information will serve as the basis for vector control procedures or immunization. Research should be initiated on the role of arthropods in the transmission of such important poultry diseases and parasites as fowlpox, avian leukosis and Leucocytozoon. It is suggested that such work can best be implemented by cooperative research programs between entomologists and veterinarians.

BEEES AND OTHER POLLINATING INSECTS

The Committee was pleased to note that basic work on the physiology of Nosema disease has begun and recommends that similar work be initiated on European foulbrood.

In 1965 the Committee recommended the immediate staffing of the Tucson Bee Laboratory. To date, this has not been done and we are informed that it is because of a lack of funds. The personnel for this laboratory are desperately needed if basic research in nutrition, physiology, biophysics, behavior, and related fields is to be initiated. The Committee again strongly recommends the complete staffing of the Tucson Bee Laboratory.

Plans for the Genetic Stock Center having been completed, it is now strongly recommended that funds for this Center be sought in order to construct it in a geographical area with mild climate and a nearly continuous pollen and honey flow.

Realizing the need for disseminating information from research scientists to apiarists, agriculturists, pollination agencies and others interested in honeybees and pollination, the establishment of a position of Apicultural Information Specialist is recommended.

